

Audio-visual interactions within the cortical hierarchy

To interact effectively with our environment, the human brain integrates information from multiple senses into a coherent percept. Neurophysiological and functional imaging studies have revealed multi-sensory interactions in a widespread neural system encompassing subcortical structures, putative ‘unisensory’ and higher order association cortices. Combining fMRI and psychophysics, we investigated where and how different types of sensory features are combined within the cortical hierarchy. We presented subjects with object pictures and sounds while factorially manipulating the relative informativeness of the auditory and visual modalities. While low level spatio-temporal interactions were found within Heschl’s gyrus, higher order object features were integrated within the superior temporal sulci (STS) bilaterally. Consistent with the law of inverse effectiveness, the multi-sensory interactions in STS were primarily suppressive for intact, but (super)additive for degraded stimuli. These distinct modes paralleled behavioral indices of multi-sensory enhancement showing the greatest multi-sensory benefit for degraded stimuli. In conclusion, the human brain integrates information that is abstracted from its sensory inputs at multiple levels of the cortical hierarchy. The operational mode of audio-visual integration is dictated by the informativeness of the auditory and visual modalities.